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INFORMATION REPORT

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THIS IS UNEVALUATED INFORMATION

SOURCE: US citizen, an official in a private firm interested in nuclear power development.

As chief engineer in the Fuel Ele[illegible]ction for his firm, source has the responsibility for keeping abreast of all developments in his field. He attended the First International Symposium on Nuclear Fuel Elements, New York, 28 and 29 Jan 59, as his firm's representative.

1. A presentation by Mr. H. K. Hardy, Chief Metallurgist, UK Atomic Energy Authority (UKAEA) on fuel element fabrication and fuel element problems in the UK was of interest to me because it gave me an insight into some of the work and problems facing nuclear fuel element engineers in the UK. Much of the information presented was new material since the Peaceful Uses of Atomic Energy Conference held in Geneva in September 1958.

2. Mr. Hardy stated that the fuel elements used in the Electricity Generating Authority's reactors are presently fabricated of the same materials as those used in the Calder Hall reactors. These fuel elements consist of natural uranium rods of controlled composition contained in magnesium alloy cans. A new factory has been recently completed by the UKAEA to manufacture these fuel elements. The present designs have been arrived at through a combination of experience from Calder Hall, theoretical analysis of the expected behavior of the individual designs in which the properties of the materials under irradiation are linked by stress analysis, and through a large scale development and testing program conducted by the UKAEA. Tests conducted thus far show that these fuel elements should achieve high irradiation levels at high ratings and temperatures.

3. According to Mr. Hardy, there are still several problems left to be solved before the fuel elements can be produced on a commercial basis. The fuel element designers have thus far been unsuccessful in combining high ratings with high fuel element life, while the manufacturing plant designers wish to have the fuel element designs completely finalized and the methods of manufacture established as early as possible. The research and development branch has the problem of proving the designs correct from the point of view of performance and ease of manufacture, and the manufacturers will require an easy process and a product which can be inspected readily to find any faulty elements.

4. Dr. A. Boettcher of Degussa, Frankfurt/M, West Germany discussed the problems encountered with fuel elements for gas-cooled high temperature reactors. He briefly covered the vast amounts of research being done to find ways of increasing the economy of nuclear power produced in gas-cooled reactors. The problem results from the fact that the gas temperature must be increased and the fuel element is presently incapable of withstanding these higher temperatures.

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5. The main difficulty lies in finding a suitable material to be used as cladding for the fuel elements. Although beryllium would permit exposures to surface temperatures up to 650°C, according to Dr. Boettcher, the unfavorable physical properties of beryllium do not presently permit the economical production of suitable beryllium tubes for cladding purposes. He also discussed the protection of fuel elements by electroplating the cladding material, but admitted that this process created a number of new problems because of the general characteristics of ceramic materials.

6. Discussing the West German "potato-heap" reactor, Dr. Boettcher stated that actual canning is avoided and spherical shaped graphite contains the actual fuel in the form of uranium carbide. Surface temperatures of the fuel elements of approximately 1000°C seem to be possible using this system; however, at the same time a certain radioactive contamination of the primary cooling system seems unavoidable. Although the fueled spheres can be of a heterogeneous or homogeneous type, the heterogeneous solution is preferred for the German gas-cooled experimental reactor.

7. My general impressions of this symposium are that only very basic and elementary information was presented. Much of the material was already known to me. Although there were over 70 foreigners in attendance, I did not have any opportunity to discuss any of the new developments with them.

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